HARMONICS – TO – NOISE RATIO IN IKA IGBO AND ENGLISH UTTERANCES: IMPLICATIONS AND INFERENCES

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ABSTRACT
Sixteen utterances comprising eight Ika Igbo utterances and eight English utterances were produced and fed into the computer. The cross – correlation method of analysis was used to obtain their harmonics – to – noise ratios. Literature on Ika Igbo does not provide about harmonics – to – noise ratio. This study gives this information and compares the harmonics – to – noise ratio (degree of acoustic periodicity) of Ika Igbo and English. The comparison is necessitated by the existence of similar intonation patterns in both languages. The analysis revealed that generally, English utterances have higher harmonicity values than those of Ika Igbo, with the difference being more marked in some intonation patterns than others. Furthermore, the only Ika Igbo utterance with higher harmonicity value had more nasal sounds than its English counterpart. It is evidently clear from this research that English generally has higher degree of periodicity than Ika Igbo and that nasality increases periodicity. In addition, it is confirmed that periodicity is determined by type of intonation pattern and that lexical tone (which exists in Ika Igbo) reduces the degree of periodicity.

1.0 INTRODUCTION

While the issue of harmonics – to – noise ratio (acoustic periodicity) may not be new in the study of English language, this is the first attempt at undertaking such a study in Ika Igbo. The need to undertake this study alongside with that of English arises from the fact that Ika Igbo, though a predominantly tone language, also has features of intonation languages. Specifically, its six basic intonation patterns are similar to those of English. However, Ika intonation patterns are not strictly perceived on the same pitch as English. It is therefore necessary to carry out a study of this sort to enable one diagnose any subtle difference between the intonation patterns of both languages. Ika Igbo dialect is linguistically different from most other Igbo dialects (Williamson, 1968). Thus it is so far the only dialect that manifests features of intonation, to a large degree, in addition to lexical tone. Ika is a dialect of Igbo language which is of the (New) Benue - Congo sub-group of the Niger – Congo language family spoken in Nigeria. It is spoken mainly in the Ika North-East and Ika South Local Government Areas of Delta State and some parts of Edo State of Nigeria. It is classified under the Niger Igbo cluster of dialects spoken in areas around the west of the River Niger (Ikekeonwu, 1986).

To account for any similarity or dissimilarity in the intonation patterns of both languages, there is need to analyse their harmonics – to noise – ratios. The measurement of the fundamental frequency (Fo) and its harmonics is a framework that is important in the analysis of intonation patterns (Crystal, 1987; 1991). The total sound output of the system that is language, is a mixture of frequencies, a complex tone, of which the wave form can be arrived at by the addition of the component sine waves, provided that the amplitude and phase of these is known (Fry, 1979). Fry shows that in speech, Fo is constantly changing but the components of the larynx tone are always harmonics of the fundamental and the effect of the resonances of the vocal tract is to produce a peak in the spectrum of the output at the harmonics which are the closest to the true resonance. This ensures that the spectrum of the resulting sound always has the same general outline in spite of the continual changing of the Fo thus ensuring sameness of quality in a range of sounds with different fundamentals. This sameness of quality enables speech sounds to perform their linguistic functions. We therefore have concentrated on the harmonics – to – noise ratio, that is, the alternation of noise with periodic (voiced) sound. Noise arises from turbulence – the random movement of air particles – which results in the continual switching from one frequency to another over a wide range of frequencies throughout the duration of the noise. The alternation of noise with periodic sound (harmonics – to – noise ratio) can be clearly seen from spectrograms or from the harmonics – to – noise ratio values. The latter has been adopted in this work.

2.0 Materials and methods

Only four of the six intonation patterns were examined since the other two, High Fall and Low Fall, appear to be universal. Eight pairs of utterances were used for each language – two pairs for one intonation pattern. In selecting these utterances, care was taken to ensure that each pair had similar or near similar phonemes. This was done to remove any effect of phonemic difference. One male native speaker produced these utterances for each language. Their productions were fed into the computer, digitized mainly at 8000 kHz frequencies and analysed with the praat software using the cross - correlation method. The harmonics – to- noise ratio values of the utterances were derived by obtaining the mean value of harmonicity. They are outlined below. The meanings of the Ika utterances are indicated beside them.

Table 1: Harmonicity values for English and Ika intonation patterns

Low Rise

	English	Ika
1.	Yes 24.79dB	Ya (you) 22dB
2.	When did you come? 24dB	We edik?? (won't they endure?) 14.8dB

High Rise

	English	Ika
3.	Who? Murray? 16.41dB	H? ah?? mar??? (That? Know?) 22.84dB
4.	Where? 19.28dB	We? (they?) 12.33dB

Fall Rise

	English	Ika
5.	Mary 17.70dB	Mme ri ? (that I ate?) 16.85dB

6. Where We? (they?)

16.63dB 17.26dB

Rise Fall

	English	Ika
7.	Good morning	O bu ?ny?? (Does it cause dysentery?)
	22.59dB	18.75dB
8.	This is mine.	Ishi manya n! (the stench of this drink!)
	19.47dB	13.68dB

3.0 **ANALYSIS:** Our table above shows that English utterances generally have higher harmonicity values than Ika. The chart below shows this more explicitly.

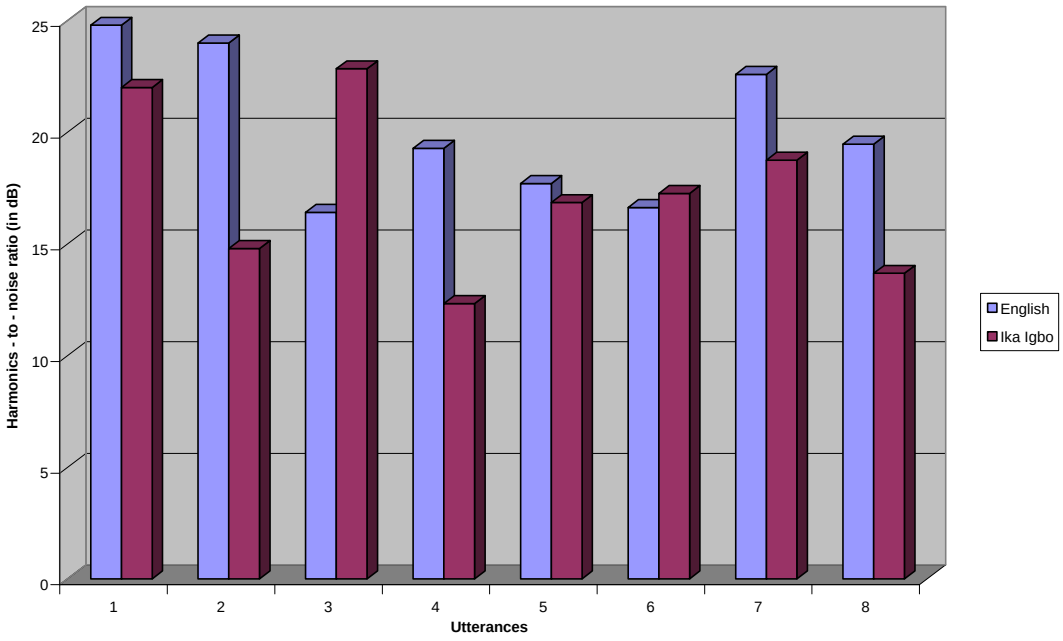

Figure1: Harmonicity values of English and Ika utterances

The first two pairs of utterances (1 and 2) bear Low Rise intonation while utterances 3 and 4 bear High Rise. The fifth and sixth pairs of utterances bear the Fall Rise intonation while the seventh and eighth pairs bear the Rise Fall intonation pattern.

Only one Ika utterance, *h? ah? mar?* has a higher harmonicity value than its English counterpart. This Ika utterance is highly nasalized. We thus conclude that because nasals have the quality of resonance, they have high periodicity hence the utterance has a higher harmonics – to – noise ratio than its English counterpart. This is confirmed by the harmonicity values we have for *when did you come* and *wé HGLN??* The high nasality in the English utterance gives it higher periodicity than its Ika counterpart hence its harmonicity value almost doubles that of Ika utterance. Also, in the Fall Rise utterances, *where / wé,* where there appears to be no nasality, we observe that their harmonicity values are approximately the same – with *where* having 16.63dB and *wé* having 17.26 dB. This is a clear indication that the former has greater harmonic component than the latter. Noisy components produce lower harmonicity values. Difference in the voices of speakers is also contributory to these differences in harmonicity values since no two speakers

have the same voice (Boersma, 2001). Aperiodic sounds – those without any harmonic basis – are discerned by the ear and the brain as noises (Fry, 1979). During their production, air particles move randomly while in periodic sounds, air particles move in a regular and patterned manner. Thus in the latter, the movement of air particles causes turbulence. We infer that since the harmonicity values of English utterances are higher than those of Ika, then English utterances have greater periodicity (voicing) than Ika utterances. However, the difference in harmonicity may be more attributed to type of intonation pattern. This is clearly seen in the differences in the harmonics – to – noise ratio values of the utterances for the different intonation patterns. A comparison of the harmonicity values of the Fall Rise utterances shows that they are relatively closer in both languages than those of other intonation patterns. Hence the nearness of the values of *where /we* Fall Rise utterances might also be attributed to the type of intonation pattern. However, the fact that the first pair of Fall Rise utterances have relatively equal amount of nasality may negate this argument. The presence of lexical tone in Ika contributed to more noise component, hence the low harmonicity. This difference, even if insignificant, could result in differences in Fos and durations thus resulting in the pitch differences between the intonation patterns of the two languages. We therefore infer that it is possible to alter the quality of intonation (that is, the intonation systems of English and Ika can be made more similar) through voice modulation. Fry (1979) who shows that the constriction of the larynx can generate either noise or voice confirm our inference. It is possible that in the attempt to constrict the larynx in such a way as to accommodate tone and intonation in Ika Igbo, turbulence of air particles, which is perceived as noise, sets in. Here, the larynx has to adjust (narrowing and widening) itself. This is contrary to what operates in English where the glottis is channelled for only intonation. Thus though the intonation patterns of both languages have harmonic and noise components, the noise generated in the production of Ika Igbo intonation is more than that of English. Consequently, similar intonation patterns in both languages are perceived as having slight differences – not strictly having the same pitch. This is reflected in the harmonics – to – noise ratio. Difference in sound quality perceived by the ear and the brain is as a result of difference in harmonics – to - noise ratio.

4.0 Conclusion

This research revealed that English, generally, has higher degree of periodicity than Ika Igbo and that nasality increases periodicity. In addition, it is confirmed that periodicity is determined by type of intonation pattern while lexical tone (which exists in Ika Igbo) reduces the degree of periodicity. Since the utterances used for the study had similar phonemes, we confirm that the difference in the harmonic – to – noise ratio is attributable to intonation (tone) mainly as well as nasality.

Our findings have some implications for English studies in Nigeria. We infer that the knowledge of the harmonics – to – noise ratio of the intonation of a language may be an important factor in learning the intonation of a second language. This knowledge is useful in Nigeria where English serves as a national language. The tendency is that most Nigerians speak English as though it was a tonal language and as a result, wrong intonation is used for this language. This affects meaning, thus hindering communication. Nigerian English language teachers could be trained to teach learners to modulate their larynx in such a way as to remove tones and other extraneous noise components while speaking English. This will increase the harmonicity, paving way for correct tune usage. Knowledge of the harmonics – to – noise ratio could therefore be a powerful tool in language use and learning.

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